

3.1 The Substitution Method

Algebra 2 5.0

Name _____

Date _____ Period _____

© When the solution of a system of equations is an ordered pair that is not located near the origin or that does not contain whole numbers, the graphic method will not be useful.

1)
$$\begin{cases} x + y = 14 \\ 3x + 2y = 48 \end{cases}$$

$$3(20) + 2(-6) = 48 \quad (20, -6)$$

$$60 - 12 = 48$$

$$48 = 48 \quad \checkmark$$

Steps:

1. Solve one of the equations for one of the variables.

$$\begin{array}{r} x + y = 14 \\ -y \quad -y \\ \hline \end{array} \quad \rightarrow \quad \boxed{x = 14 - y}$$

2. Substitute this expression into the other equation and solve.

$$3x + 2y = 48$$

$$3(14 - y) + 2y = 48 \rightarrow 42 - 3y + 2y = 48$$

$$42 - y = 48$$

3. Find the corresponding value of the other variable.

$$x = 14 - y$$

$$x = 14 - (-6) \quad \boxed{x = 20}$$

$$-y = 6 \quad \boxed{y = -6}$$

4. Check into both equations.

$$2) \begin{cases} 3x + 2y = 11 \\ x + 4y = 2 \end{cases}$$

$$\begin{array}{r} x + 4y = 2 \\ -4y \quad -4y \\ \hline \end{array}$$

$$\boxed{x = -4y + 2}$$

$$3x + 2y = 11$$

$$3(-4y + 2) + 2y = 11$$

$$-12y + 6 + 2y = 11$$

$$\begin{array}{r} -10y + 6 = 11 \\ -6 \quad -6 \\ \hline \end{array}$$

$$\leftarrow -10y = 5$$

$$\begin{array}{r} -10y = 5 \\ \div -10 \quad \div -10 \\ \hline y = -\frac{1}{2} \end{array}$$

$$(4, -\frac{1}{2})$$

$$x = -4y + 2$$

$$x = -4(-\frac{1}{2}) + 2$$

$$\boxed{x = 4}$$

$$3(4) + 2(-\frac{1}{2}) = 11$$

$$12 - 1 = 11$$

$$11 = 11 \quad \checkmark$$

$$3) \begin{cases} x = 3y \\ 2x - 5y = 4 \end{cases}$$

$$2x - 5y = 4$$

$$2(3y) - 5y = 4$$

$$6y - 5y = 4$$

$$y = 4$$

$$x = 3(4)$$
$$x = 12$$

$$2(12) - 5(4) = 4$$

$$24 - 20 = 4$$

$$4 = 4 \checkmark$$

$$(12, 4)$$

$$4) \begin{cases} 2x - y = 1 \\ 3y + 3 = 6x \end{cases}$$

$$\begin{array}{r} 2x - y = 1 \\ -2x \quad -2x \\ \hline -y = -2x + 1 \\ \frac{-1}{-1} \quad \frac{-1}{-1} \quad \frac{-1}{-1} \\ \hline \boxed{y = 2x - 1} \end{array}$$

$$\begin{aligned} 3y + 3 &= 6x \\ 3(2x - 1) + 3 &= 6x \\ 6x - 3 + 3 &= 6x \end{aligned}$$

$$\begin{array}{r} 6x = 6x \\ -6x \quad -6x \\ \hline 0 = 0 \end{array}$$

CONSISTENT
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$$5) \begin{cases} 4m - 3n = 23 \\ m + 4n = 1 \end{cases}$$

$$m + 4n = 1$$

$$\quad -4n \quad -4n$$

$$\boxed{m = -4n + 1}$$

$$4(-4n + 1) - 3n = 23$$

$$-16n + 4 - 3n = 23$$

$$-19n + 4 = 23$$

$$\quad -4 \quad -4$$

$$\hline -19n = 19$$

$$\boxed{n = -1}$$

$$(5, -1)$$

$$m = -4(-1) + 1$$

$$\boxed{m = 5}$$

$$4(5) - 3(-1) = 23$$

$$20 + 3 = 23$$

$$23 = 23 \quad \checkmark$$

Homework
Complete 3.1
#1 - 12